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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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NATH & ASSOCIATES 112 South West Street Alexandria, VA 22314			EXAMINER HANOR, SERENA L	
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/588,216

Applicant(s)

KARVINEN ET AL.

Examiner

SERENA L. HANOR

Art Unit

1793

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 08/02/2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-25 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-25 is/are rejected.
- 7) ☒ Claim(s) 11 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 02 August 2006 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-8508)
- Paper No(s)/Mail Date 08/02/2006
- 4) ☐ Interview Summary (PTO-413)
- Paper No(s)/Mail Date _____
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____

DETAILED ACTION

Claim Objections

Claim 11 is objected to because of the following informalities: "specific surface" should read "specific surface area", and " g/m^2 " should read " m^2/g ". Appropriate correction is required.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

1. Claims 2-12 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

A broad range or limitation together with a narrow range or limitation that falls within the broad range or limitation (in the same claim) is considered indefinite, since the resulting claim does not clearly set forth the metes and bounds of the patent protection desired. See MPEP § 2173.05(c). Note the explanation given by the Board of Patent Appeals and Interferences in *Ex parte Wu*, 10 USPQ2d 2031, 2033 (Bd. Pat. App. & Inter. 1989), as to where broad language is followed by "such as" and then narrow language. The Board stated that this can render a claim indefinite by raising a question or doubt as to whether the feature introduced by such language is (a) merely exemplary of the remainder of the claim, and therefore not required, or (b) a required feature of the claims. Note also, for example, the decisions of *Ex parte Steigewald*, 131

USPQ 74 (Bd. App. 1961); *Ex parte Hall*, 83 USPQ 38 (Bd. App. 1948); and *Ex parte Hasche*, 86 USPQ 481 (Bd. App. 1949).

- a. In the present instance, claim 2 recites the broad recitation 95-300, and the claim also recites 100-250 and 150-230, which are the narrower statements of the range/limitation.
- b. In the present instance, claim 3 recites the broad recitation 0.5-10% by weight, and the claim also recites 1-7, 1.5-5 and 2-5, which are the narrower statements of the range/limitation.
- c. In the present instance, claim 4 recites the broad recitation 5-100 g TiO₂/l, and the claim also recites 10-80 and 10-50, which are the narrower statements of the range/limitation.
- d. In the present instance, claim 5 recites the broad recitation 1-15 nm, and the claim also recites 5-15 nm, which is the narrower statement of the range/limitation.
- e. In the present instance, claim 6 recites the broad recitation rutile and/or anatase crystal form, and the claim also recites more than 20% rutile, which is the narrower statement of the range/limitation.
- f. In the present instance, claim 7 recites the broad recitation 50-100°C, and the claim also recites 60-100°C and 70-98C, which are the narrower statements of the range/limitation.
- g. In the present instance, claim 8 recites the broad recitation pH range of 6-10, and the claim also recites 7-9, which is the narrower statement of the range/limitation.

- h. In the present instance, claim 9 recites the broad recitation a temperature below 700°C, and the claim also recites 100-500°C and 150-400°C, which are the narrower statements of the range/limitation.
 - i. In the present instance, claim 10 recites the broad recitation average diameter of <50 nm, and the claim also recites 5-30 nm and 5-20 nm, which are the narrower statements of the range/limitation.
 - j. In the present instance, claim 11 recites the broad recitation specific surface area of 10-500 m²/g, and the claim also recites 10-30 m²/g, which is the narrower statement of the range/limitation.
 - k. In the present instance, claim 12 recites the broad recitation predominantly rutile, and the claim also recites >70%, >80% and >90%, which are the narrower statements of the range/limitation.
2. Claim 12 is rejected under 35 U.S.C. 112, second paragraph, as being incomplete for omitting essential elements, such omission amounting to a gap between the elements. See MPEP § 2172.01. The omitted elements are: if the titanium dioxide refers to the crystals or the final product. For the sake of the prior art rejections, Examiner assumes that it refers to the final product.

Claim Rejections - 35 USC § 101

35 U.S.C. 101 reads as follows:

Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

Claims 18-20, 23 and 24 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claims 18-20, 23 and 24 provide for the use of a titanium dioxide product, but, since the claims do not set forth any steps involved in the method/process, it is unclear what method/process applicant is intending to encompass. A claim is indefinite where it merely recites a use without any active, positive steps delimiting how this use is actually practiced.

Claims 18-20, 23 and 24 are rejected under 35 U.S.C. 101 because the claimed recitation of a use, without setting forth any steps involved in the process, results in an improper definition of a process, i.e., results in a claim which is not a proper process claim under 35 U.S.C. 101. See for example *Ex parte Dunki*, 153 USPQ 678 (Bd.App. 1967) and *Clinical Products, Ltd. v. Brenner*, 255 F. Supp. 131, 149 USPQ 475 (D.D.C. 1966).

Double Patenting

A rejection based on double patenting of the "same invention" type finds its support in the language of 35 U.S.C. 101 which states that "whoever invents or discovers any new and useful process ... may obtain a patent therefor ..." (Emphasis added). Thus, the term "same invention," in this context, means an invention drawn to identical subject matter. See *Miller v. Eagle Mfg. Co.*, 151 U.S. 186 (1894); *In re Ockert*, 245 F.2d 467, 114 USPQ 330 (CCPA 1957); and *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970).

A statutory type (35 U.S.C. 101) double patenting rejection can be overcome by canceling or amending the conflicting claims so they are no longer coextensive in scope. The filing of a terminal disclaimer cannot overcome a double patenting rejection based upon 35 U.S.C. 101.

Applicant is advised that should claims 18, 21 and 22 be found allowable, claims 23, 24 and 25 will be objected to under 37 CFR 1.75 as being a substantial duplicate thereof. When two claims in an application are duplicates or else are so close in content that they both cover the same thing, despite a slight difference in wording, it is proper after allowing one claim to object to the other as being a substantial duplicate of the allowed claim. See MPEP § 706.03(k).

Claim Rejections - 35 USC § 102/103

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) and the Intellectual Property and High Technology Technical Amendments Act of 2002 do not apply when the reference is a U.S. patent resulting directly or indirectly from an international application filed before November 29, 2000. Therefore, the prior art date of the reference is determined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

The person having ordinary skill in the art has the capability of understanding the scientific and engineering principles applicable to the claimed invention. The references of record in this application reasonably reflect this level of skill.

1. Claims 1-4, 7, 9, 10, 14-17, 21 and 24 are rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Jones et al. (U.S. Patent No. 5,024,827).

Jones et al. disclose a process for manufacturing a particulate titanium dioxide product, wherein:

- i. titanium dioxide particles are added as crystal nuclei (col. 2 lines 3-17) at 0.5-10% by weight (1-7, 1.5-5, 2-5) calculated on the basis of the total titanium content in the solution of titanium oxychloride and expressed as TiO_2 (col. 2 lines 25-29, *Applicants' claim 3*), as a suspension (aqueous suspension) with a content of 5-100 g TiO_2/l (10-80 g/l, 10-50 g/l) (col. 3 lines 29-34, *Applicants' claim 4*), to an aqueous solution of titanium oxychloride with a content of >90 g TiO_2/l (col. 2 lines 3-8, col. 3 lines 29-34), or more preferably 95-300 (100-250 or 150-230) g TiO_2/l (col. 3 lines 29-34, *Applicants' claim 2*),
- ii. hydrated titanium dioxide is precipitated from the solution at a temperature below the boiling point of said solution, specifically 50-100°C (60-100°C and 70-98°C) (col. 2 lines 3-8, col. 2 line 67-col. 3 line 4, *Applicants' claim 7*) and at normal pressure, and
- iii. the precipitate is isolated and optionally calcined at a temperature below 700°C (100-500°C or 150-400°C) (col. 3 lines 5-13, *Applicants' claim 9*). *Applicants' claim 1*.

The photocatalytically active titanium dioxide product (col. 3 lines 14-16, *Applicants' claims 14, 17, 21 and 24*) has the following properties:

- a) crystals with an average diameter of <50nm (5-30 or 5-20nm) (col. 1 lines 28-31, *Applicants' claim 10*)

- b) activity in the UV region of light (col. 3 lines 14-16, *Applicants' claim 15*)
- c) activity in the visible region of light (col. 3 lines 14-16, *Applicants' claim 16*)

"[E]ven though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process." *In re Thorpe*, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985) (citations omitted). See MPEP 2113 [R-1]. *Applicants' claims 14, 17, 21 and 24*.

Jones et al. differ from the instant invention in that the diameter of the titanium dioxide particles overlaps and/or falls within the range of the instantly claimed diameter.

It would have obvious to one of ordinary skill in the art at the time of the invention **to have selected the reaction conditions necessary to yield a titanium dioxide product with a particle size with an average diameter within the instantly claimed range**, as per Applicants' claim 10, **because a prima facie case of obviousness exists** in the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art". *In re Wertheim*, 541 F.2d 257, 191 USPQ 90 (CCPA 1976); *In re Woodruff*, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir. 1990). Furthermore, "[A] prior art reference that discloses a range encompassing a somewhat narrower claimed range is sufficient to establish a prima facie case of obviousness." *In re Peterson*, 315 F.3d 1325, 1330, 65 USPQ2d 1379, 1382-83 (Fed. Cir. 2003). See MPEP 2144.05 [R-5].

Jones et al. differ from the instant invention in that the content of TiO₂ of the aqueous titanium oxychloride solution overlaps and/or falls within the range of the instantly claimed content.

It would have obvious to one of ordinary skill in the art at the time of the invention **to have selected a content of TiO₂ disclosed by the instant invention**, as per Applicants' claims 1 and 2, **because a prima facie case of obviousness exists** in the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art". *In re Wertheim*, 541 F.2d 257, 191 USPQ 90 (CCPA 1976); *In re Woodruff*, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir. 1990). Furthermore, "[A] prior art reference that discloses a range encompassing a somewhat narrower claimed range is sufficient to establish a prima facie case of obviousness." *In re Peterson*, 315 F.3d 1325, 1330, 65 USPQ2d 1379, 1382-83 (Fed. Cir. 2003). See MPEP 2144.05 [R-5].

Jones et al. differ from the instant invention in that the precipitation reaction temperature overlaps and/or encompasses the instantly claimed range.

It would have obvious to one of ordinary skill in the art at the time of the invention **to have selected a precipitation reaction temperature disclosed by the instant invention**, as per Applicants' claim 7, **because a prima facie case of obviousness exists** in the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art". *In re Wertheim*, 541 F.2d 257, 191 USPQ 90 (CCPA 1976); *In re Woodruff*, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir. 1990). Furthermore, "[A] prior art reference that discloses a range encompassing a somewhat narrower claimed range is sufficient

to establish a prima facie case of obviousness." *In re Peterson*, 315 F.3d 1325, 1330, 65 USPQ2d 1379, 1382-83 (Fed. Cir. 2003). See MPEP 2144.05 [R-5].

2. Claims 1, 5-7, 9-12, 14-17, 21 and 24 are rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Li et al. (A novel method for preparation of nanocrystalline rutile TiO₂ powders by liquid hydrolysis of TiCl₄).

Li et al. disclose a process for manufacturing a particulate titanium dioxide product, wherein:

- i. rutile and/or anatase (>20% rutile) (*Applicants' claim 6*) titanium dioxide particles with an average particle size of 1-15 nm (5-15 nm) (*Applicants' claim 5*) are added as crystal nuclei (p. 1387 col. 2, p. 1388 Table 1) to an aqueous solution of titanium oxychloride (the hydrolysis of titanium tetrachloride yields titanium oxychloride) with a content of >90 g TiO₂/l (p. 1387 col. 2),
- ii. hydrated titanium dioxide is precipitated from said solution at a temperature below the boiling point of said solution, specifically 50-100°C (60-100°C and 70-98°C) (*Applicants' claim 7*) and at normal pressure (p. 1387 col. 2, p. 1388 Table 1), and
- iii. the precipitate is isolated and optionally calcined at a temperature below 700°C (100-500°C or 150-400°C) (p. 1387 col. 2, p. 1388 col. 1, *Applicants' claim 9*).
Applicants' claim 1.

The photocatalytically active titanium dioxide product (Abstract, p. 1387 col. 1, p. 1388 Table 1, p. 1390 col. 1 Figure 6, *Applicants' claims 14, 17, 21 and 24*) has the following properties:

- a) crystals with an average diameter of <50nm (5-30 or 5-20nm) (*Applicants' claim 10*)
- b) a specific surface area of 10-500 m²/g (10-300 m²/g) (*Applicants' claim 11*)
- c) a crystal form of predominantly rutile (>70% and >80% and >90%) (*Applicants' claim 12*)
- d) activity in the UV region of light (*Applicants' claim 15*)
- e) activity in the visible region of light (*Applicants' claim 16*)

"[E]ven though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process." *In re Thorpe*, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985) (citations omitted). See MPEP 2113 [R-1]. *Applicants' claims 14 and 17*.

Li et al. differ from the instant invention in that the range of crystal diameters of the nuclei seed and of the final product falls within the instantly claimed range.

It would have obvious to one of ordinary skill in the art at the time of the invention **to have selected a seed size that would influence the product size to fall within in the instantly claimed ranges and thus yield a product with the necessary size**, as per Applicants' claims 5 and 10, **because a prima facie case of obviousness exists** in the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art". *In re Wertheim*, 541 F.2d 257, 191 USPQ 90 (CCPA 1976); *In re Woodruff*, 919 F.2d

1575, 16 USPQ2d 1934 (Fed. Cir. 1990). Furthermore, "[A] prior art reference that discloses a range encompassing a somewhat narrower claimed range is sufficient to establish a prima facie case of obviousness." *In re Peterson*, 315 F.3d 1325, 1330, 65 USPQ2d 1379, 1382-83 (Fed. Cir. 2003). See MPEP 2144.05 [R-5].

Li et al. differ from the instant invention in that the content of TiO₂ in the aqueous solution of titanium oxychloride is not disclosed.

It would have obvious to one of ordinary skill in the art at the time of the invention **to have selected an aqueous solution of titanium oxychloride with a content of TiO₂ of >90 g/l in order to react properly with the seed material to yield a titanium dioxide product like the instantly claimed one**, as per Applicants' claim 1, **because** differences in concentration or temperature will not support the patentability of subject matter encompassed by the prior art unless there is evidence indicating such concentration or temperature is critical. "[W]here the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation." *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955).

Li et al. differ from the instant invention in that the range of the specific surface area of the crystals falls within the instantly claimed range.

It would have obvious to one of ordinary skill in the art at the time of the invention **to have selected the necessary reaction conditions to obtain a product with a specific surface area disclosed by the instant invention**, as per Applicants' claim 11, **because a prima facie case of obviousness exists** in the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art". *In re Wertheim*, 541 F.2d 257, 191 USPQ

90 (CCPA 1976); *In re Woodruff*, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir. 1990). Furthermore, "[A] prior art reference that discloses a range encompassing a somewhat narrower claimed range is sufficient to establish a prima facie case of obviousness." *In re Peterson*, 315 F.3d 1325, 1330, 65 USPQ2d 1379, 1382-83 (Fed. Cir. 2003). See MPEP 2144.05 [R-5].

3. Claims 1-10, 12-17, 21, 22, 24 and 25 are rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Murasawa (EP 0 376 216 A1).

Murasawa discloses a process for manufacturing a particulate titanium dioxide product, wherein:

- i. rutile and/or anatase (>20% rutile) titanium dioxide particles with an average particle size of 1-15 nm (5-15 nm) (p. 3 lines 11-24, *Applicants' claims 5 and 6*) are added as crystal nuclei at 0.5-10% by weight (1-7, 1.5-5, 2-5) calculated on the basis of the total titanium content in the solution of titanium oxychloride and expressed as TiO₂ (p. 6 lines 24-26, *Applicants' claim 3*), as a suspension (aqueous suspension) with a content of 5-100 g TiO₂/l (10-80 g/l, 10-50 g/l) (p. 3 lines 21-24, p. 6 lines 21-23, *Applicants' claim 4*), to an aqueous solution of titanium oxychloride with a content of >90 g TiO₂/l, or more preferably 95-300 (100-250 or 150-230) g TiO₂/l (p. 3 lines 25-29, p. 6 line 20, *Applicants' claim 2*),
- ii. an acid or salt sulphate, which is 1-5% by weight calculated on the basis of the amount of TiO₂ in the solution, is added (p. 5 lines 4-14, *Applicants' claim 13*),

- iii. hydrated titanium dioxide is precipitated from said solution at a temperature below the boiling point of said solution, specifically 50-100°C (60-100°C and 70-98°C) (p. 3 lines 25-37, p. 6 line 1, *Applicants' claim 7*) and at normal pressure, and
- iv. the precipitate is isolated and washed and neutralized with a base to a pH range of 6-10 (7-9) (p. 6 lines 26-27, *Applicants' claim 8*) and optionally calcined at a temperature below 700°C (100-500°C or 150-400°C) (p. 3 lines 36-44, *Applicants' claim 9*). *Applicants' claim 1*.

The photocatalytically active titanium dioxide product (p. 2 lines 33-37, *Applicants' claims 14 and 17*) has the following properties:

- a) crystals with an average diameter of <50nm (5-30 or 5-20nm) (p. 4 lines 54-57, *Applicants' claim 10*)
- b) a crystal form of predominantly rutile (>70% and >80% and >90%) (Abstract, p. 4 lines 24-25, *Applicants' claim 12*)
- c) activity in the UV region of light (Abstract, *Applicants' claim 15*)
- d) activity in the visible region of light (Abstract, *Applicants' claim 16*)

Murasawa further discloses a photocatalyst comprising a titanium dioxide product (p. 2 lines 33-37, p. 5 lines 15-21 and 25-29, *Applicants' claims 21 and 24*).

Murasawa further discloses a product, which has a surface coated at least in part with a photocatalyst coating, which comprising a titanium dioxide product (p. 2 lines 33-37, p. 5 lines 30-41, p. 6 lines 40-46, *Applicants' claims 22 and 25*).

"[E]ven though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability

of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process." *In re Thorpe*, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985) (citations omitted). See MPEP 2113 [R-1]. *Applicants' claims 14-17, 21, 22, 24 and 25.*

Murasawa differs from the instant invention in that the particle size of the titanium dioxide seed overlaps and/or falls within the range of the instantly claimed diameter.

It would have obvious to one of ordinary skill in the art at the time of the invention **to have selected a crystal size that was disclosed by both Murasawa and the instant invention**, as per Applicants' claim 5, **because a prima facie case of obviousness exists** in the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art". *In re Wertheim*, 541 F.2d 257, 191 USPQ 90 (CCPA 1976); *In re Woodruff*, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir. 1990). Furthermore, "[A] prior art reference that discloses a range encompassing a somewhat narrower claimed range is sufficient to establish a prima facie case of obviousness." *In re Peterson*, 315 F.3d 1325, 1330, 65 USPQ2d 1379, 1382-83 (Fed. Cir. 2003). See MPEP 2144.05 [R-5].

Murasawa differs from the instant invention in that the content of TiO₂ in the aqueous suspension differs from that of the instant invention.

It would have been obvious to one of ordinary skill in the art at the time the invention was made **to have selected a content of TiO₂ that would yield the instantly claimed product**, as per Applicants' claim 4, **because a prima facie case of obviousness exists** where the claimed ranges and prior art ranges do not overlap but are close

enough that one skilled in the art would have expected them to have the same properties. *Titanium Metals Corp. of America v. Banner*, 778 F.2d 775, 227 USPQ 773 (Fed. Cir. 1985). Generally, differences in concentration or temperature will not support the patentability of subject matter encompassed by the prior art unless there is evidence indicating such concentration or temperature is critical. "[W]here the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation." *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955).

Murasawa differs from the instant invention in that the amount of sulphate salt added overlaps and/or lies within the instantly claimed range.

It would have obvious to one of ordinary skill in the art at the time of the invention **to have selected an amount of sulphate disclosed by the instant invention**, as per Applicants' claim 13, **because a prima facie case of obviousness exists** in the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art". *In re Wertheim*, 541 F.2d 257, 191 USPQ 90 (CCPA 1976); *In re Woodruff*, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir. 1990). Furthermore, "[A] prior art reference that discloses a range encompassing a somewhat narrower claimed range is sufficient to establish a prima facie case of obviousness." *In re Peterson*, 315 F.3d 1325, 1330, 65 USPQ2d 1379, 1382-83 (Fed. Cir. 2003). See MPEP 2144.05 [R-5]. Generally, differences in concentration or temperature will not support the patentability of subject matter encompassed by the prior art unless there is evidence indicating such concentration or temperature is critical. "[W]here the general conditions of a claim are disclosed in the

prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation." *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955).

Murasawa differs from the instant invention in that the precipitation reaction temperature overlaps and/or lies within the instantly claimed range.

It would have obvious to one of ordinary skill in the art at the time of the invention **to have selected a precipitation reaction temperature disclosed by the instant invention**, as per Applicants' claim 7, **because a prima facie case of obviousness exists** in the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art". *In re Wertheim*, 541 F.2d 257, 191 USPQ 90 (CCPA 1976); *In re Woodruff*, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir. 1990). Furthermore, "[A] prior art reference that discloses a range encompassing a somewhat narrower claimed range is sufficient to establish a prima facie case of obviousness." *In re Peterson*, 315 F.3d 1325, 1330, 65 USPQ2d 1379, 1382-83 (Fed. Cir. 2003). See MPEP 2144.05 [R-5].

Murasawa differs from the instant invention in that it does not disclose the neutralization step as having a pH of 6-10.

It would have obvious to one of ordinary skill in the art at the time of the invention **to have recognized that neutralization implies a pH of about 7, which falls within the instantly claimed range**, as per Applicants' claim 8, **because** differences in concentration or temperature will not support the patentability of subject matter encompassed by the prior art unless there is evidence indicating such concentration or temperature is critical. "[W]here the general conditions of a claim are disclosed in the

prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation." *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955).

Murasawa differs from the instant invention in that the calcination temperature range overlaps and/or lies within that of the instantly claimed range.

It would have obvious to one of ordinary skill in the art at the time of the invention **to have selected a calcination temperature that would yield the instantly claimed product**, as per Applicants' claim 9, **because a prima facie case of obviousness exists** in the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art". *In re Wertheim*, 541 F.2d 257, 191 USPQ 90 (CCPA 1976); *In re Woodruff*, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir. 1990). Furthermore, "[A] prior art reference that discloses a range encompassing a somewhat narrower claimed range is sufficient to establish a prima facie case of obviousness." *In re Peterson*, 315 F.3d 1325, 1330, 65 USPQ2d 1379, 1382-83 (Fed. Cir. 2003). See MPEP 2144.05 [R-5]. Generally, differences in concentration or temperature will not support the patentability of subject matter encompassed by the prior art unless there is evidence indicating such concentration or temperature is critical. "[W]here the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation." *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955).

Murasawa differs from the instant invention in that the diameter of the titanium dioxide particles overlaps and/or falls within the range of the instantly claimed diameter.

It would have been obvious to one of ordinary skill in the art at the time the invention was made **to have selected the reaction conditions necessary to yield a product with a smaller particle size as it is known that the seed size influences the product size**, as per Applicants' claim 10, **because a prima facie case of obviousness exists** where the claimed ranges and prior art ranges do not overlap but are close enough that one skilled in the art would have expected them to have the same properties. *Titanium Metals Corp. of America v. Banner*, 778 F.2d 775, 227 USPQ 773 (Fed. Cir. 1985). Generally, differences in concentration or temperature will not support the patentability of subject matter encompassed by the prior art unless there is evidence indicating such concentration or temperature is critical. "[W]here the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation." *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955).

4. Claims 14-17, 21, 22, 24 and 25 are rejected under 35 U.S.C. 102(e) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Bygott et al. (U.S. Patent Application Publication No. 2004/0092393 A1).

Bygott et al. disclose a photocatalytically active titanium dioxide product (p. 1 [0013-0014], p. 2 [0027] and [0034], *Applicants' claims 14, 17, 21 and 24*) has the following properties:

- a) crystals with an average diameter of <50nm (5-30 or 5-20nm) (p. 2 [0018], *Applicants' claim 10*)

- b) a specific surface area of 10-500 m²/g (10-300 m²/g) (p. 1 [0017], *Applicants' claim 11*)
- c) a crystal form of predominantly rutile (>70% and >80% and >90%) (p. 1 [0015], p. 2 [0030], *Applicants' claim 12*)
- d) activity in the UV region of light (p. 2 [0026], *Applicants' claim 15*)
- e) activity in the visible region of light (p. 2 [0026], *Applicants' claim 16*)

"[E]ven though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process." *In re Thorpe*, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985) (citations omitted). See MPEP 2113 [R-1]. *Applicants' claims 14, 17, 21 and 24*.

Bygott et al. further disclose a product, which has a surface coated at least in part with a photocatalyst coating, which comprising a titanium dioxide product (p. 2 [0034], *Applicants' claims 22 and 25*).

Bygott et al. differ from the instant invention in that the specific surface area range overlaps that of the instant invention.

It would have obvious to one of ordinary skill in the art at the time of the invention **to have recognized that a titanium dioxide product with the instantly claimed specific surface area could be produced by the method of Bygott et al.**, as per Applicants' claim 11, **because a prima facie case of obviousness exists** in the case where the claimed

ranges "overlap or lie inside ranges disclosed by the prior art". *In re Wertheim*, 541 F.2d 257, 191 USPQ 90 (CCPA 1976); *In re Woodruff*, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir. 1990). Furthermore, "[A] prior art reference that discloses a range encompassing a somewhat narrower claimed range is sufficient to establish a prima facie case of obviousness." *In re Peterson*, 315 F.3d 1325, 1330, 65 USPQ2d 1379, 1382-83 (Fed. Cir. 2003). See MPEP 2144.05 [R-5].

Bygott et al. differ from the instant invention in that the average diameter range of their product overlaps that of the instant invention.

It would have obvious to one of ordinary skill in the art at the time of the invention **to have recognized that a titanium dioxide product with the instantly average diameter could be produced by the method of Bygott et al.**, as per Applicants' claim 10, **because a prima facie case of obviousness exists** in the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art". *In re Wertheim*, 541 F.2d 257, 191 USPQ 90 (CCPA 1976); *In re Woodruff*, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir. 1990). Furthermore, "[A] prior art reference that discloses a range encompassing a somewhat narrower claimed range is sufficient to establish a prima facie case of obviousness." *In re Peterson*, 315 F.3d 1325, 1330, 65 USPQ2d 1379, 1382-83 (Fed. Cir. 2003). See MPEP 2144.05 [R-5].

Conclusion

Claims 1-25 have been rejected.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to SERENA L. HANOR whose telephone number is

(571)270-3593. The examiner can normally be reached on Monday - Thursday 8:00 AM - 5:30 PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stanley Silverman can be reached on (571) 272-1358. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

SLH

/Timothy C Vanoy/
Primary Examiner, Art Unit 1793